

## Response of Mustard to Nitrogen and Irrigation Under High Water Table Conditions in Hirakud Ayacut Area

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Growth and development of *toris* mustard (Cv. Appressed mutant) grown in a nitrogen poor loamy sand high land soil in Hirakud ayacut area responded linearly upto 75 kg N/ha. Under high water table conditions fluctuating within 69-120 cm below surface during November to January, the response to irrigation at 25, 50 and 75% depletion of available moisture was not significant. Consumptive use and water requirements were 216 and 241 mm, respectively.

In Orissa mustard is cultivated in 85,882 ha an with average yield of only 350 kg/ha. Nitrogen application up to 60-90 kg/ha (Singh and Tomar, 1971; Dayananda and Mahapatra, 1974) and irrigation at suitable intervals (Singh *et al.*, 1974) increased the yield significantly over control. This paper reports the response of mustard (Cv. Appressed mutant) to nitrogen and irrigation under Hirakud ayacut area.

### MATERIALS AND METHODS

The mustard (Cv. Appressed mutant) was sown in October 1971 and 1972 in a loamy sand high land soil. The soil was poor in available N (0.025 per cent) and medium in available P and K (0.0009 and 0.015 per cent respectively).

The experiment was conducted with graded doses of 0, 25, 50 and 75 kg N (Ammonium sulphate) with basal dose of 23 kg P<sub>2</sub>O<sub>5</sub> and 30 kg K<sub>2</sub>O per ha and irrigated at 25, 50 and 75 per cent depletion of available moisture up

to 90 cm depth, in randomised block design with four replications. Irrimeters were fixed in 25 and 50 per cent depletion irrigated plots to guide time of irrigation. Irrigation was applied through a 7.5 cm Parahall flume to make good the deficit to field capacity. Moisture content at sowing, before and after each irrigation and at harvest were determined gravimetrically. During the months of November, December and January the water table remained 93, 120 and 69 cm below surface respectively. The rainfall of 20.8 mm received in two showers only during 1972-73 season was considered effective.

### RESULTS AND DISCUSSION

Application of N increased branching, height and number of siliqua per plant over control significantly and increased the yield of grain and sticks (Table I and II). Similar response of mustard to N has been reported by Gupta *et al.*, (1972) and Panwar and

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TABLE I. Response of growth and development of mustard var Appressed mutant to nitrogen and irrigation

Particulars	Branches/plant			Height (cm)			Siliqua/plant			Siliqua length (cm)			Seeds/siliqua			1000 grain wt (g)		
	1971-72	1972-73	Mean	1971-72	1972-73	Mean	1971-72	1972-73	Mean	1971-72	1972-73	Mean	1971-72	1972-73	Mean	1971-72	1972-73	Mean
Levels of N (kg/ha)																		
0	1.0	1.5	1.25	72.5	63.5	68.0	47.8	21.5	39.65	39	11.4	9.8	20.6	2.40	2.03	2.21		
25	1.98	3.1	2.65	77.4	67.0	72.2	60.7	28.2	44.45	42	12.1	10.4	11.3	2.60	2.04	2.32		
50	3.2	5.6	4.4	80.0	75.1	77.5	83.7	41.0	62.35	42	11.5	11.4	11.5	2.65	2.26	2.42		
75	4.1	6.1	5.1	79.7	75.3	77.6	82.9	49.6	66.25	33	12.0	11.4	11.7	2.20	2.00	2.10		
S. E. M. ±	0.3	0.32	—	3.2	2.9	—	6.8	3.2	—	0.06	0.3	0.33	—	0.04	0.03	—		
CD (0.05)	0.9	0.96	—	9.8	8.3	—	19.3	9.1	—	0.17	—	—	—	0.13	—	—		
Irrigation at																		
25% Depletion	2.6	3.7	3.15	73.2	73.1	73.1	60.5	37.1	48.8	40	11.2	10.6	10.9	2.75	2.0	2.37		
50% Depletion	2.4	4.6	3.5	80.5	70.8	75.6	76.1	32.9	54.5	42	12.1	10.7	11.4	2.50	2.6	2.55		
75% Depletion	2.6	4.1	—	75.8	69.9	72.8	69.7	35.2	52.4	4.2	11.9	10.9	11.4	2.50	2.8	2.65		
CD (0.05)							16.4			0.1	0.75			0.13	1.0			

TABLE II. Response of the yield of grains and sticks to levels of nitrogen and irrigation

Particulars	Grain (q/ha)			Sticks (q/ha)			Response equation
	1971-72	1972-73	Mean	1971-72	1972-73	Mean	
Levels of N (Kg/ha)							
0	4.47	2.59	3.53	13.18	5.44	9.31	* $Y_g = 3.939 + 3.41 N$
25	6.67	4.34	5.00	17.73	6.01	11.59	** $Y_g = 2.49 + 0.99 N$
50	10.87	4.42	7.65	30.23	8.61	19.42	$Y_{gm} = 3.25 + 2.20 N$
75	14.48	5.50	9.99	35.41	10.48	22.82	* $Y_s = 12.31 + 7.84 N$
Mean S.E.M. ±	0.55	0.32	0.32	1.51	0.63	—	** $Y_s = 4.99 + 1.77 N$
CD (0.05)	1.60	0.98	0.91	4.35	1.82	—	** -1971-72 ** -1972-73
Irrigation at							
25% depletion	9.26	4.09	6.67	23.35	7.88	15.56	Ygm-Mean of 2 seasons
50% depletion	9.62	4.06	6.83	25.57	7.78	16.67	g-grain, s-sticks
75% depletion	8.43	3.72	6.12	23.23	7.24	15.29	
S. E. M. ±	0.48	0.28	0.28	1.31	0.64		
	N.S.	N.S.	N.S.	N.S.	N.S.		

Bhardwaj (1975). The number of seeds per siliqua and 1000 grain weight were not influenced by N application. In both the seasons the yield response of grain to N was linear, the average response being 220 kg per 25 kg N per ha ( $Y_{gm} = 3.25 + 2.20 N$ ) (Table II and Fig. 1).

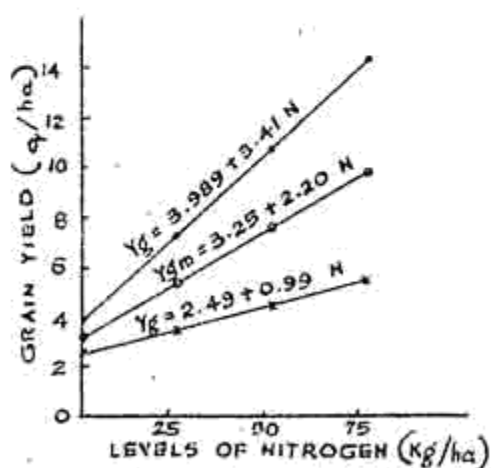


Fig 1. RESPONSE OF MUSTARD GRAIN YIELD TO LEVELS OF NITROGEN

In the second season the yield of mustard (400 kg/ha) was lower than that (900 kg/ha) of the first season due to scarcity of water till mid December on account of canal closure which resulted in recession of water table below 120 cm eliminating the contribution of ground water through capillary rise. The response of growth and yield of mustard to irrigation at different levels of depletion of available moisture was not significant due to high water table during greater part of the crop season (Table III). It may be inferred that irrigation at 75 per cent depletion of available moisture under conditions of fluctuating high water table conditions is sufficient to maintain the grain yield levels.

Consumptive use of mustard crop was 170 mm with the irrigation at

TABLE III. Consumptive use and water requirement of mustard

Particulars	No. of irrigations			Consumptive (mm)			Water requirement (mm)			Water use efficiency (Kg/ha/cm)	
	1971-72	1972-73	Mean	1971-72	1972-73	Mean	1971-72	1972-73	Mean	Kg. grain	Dry matter
	Irrigation at										
25% depletion	5	3	4	145	196	170	232	205	218	39.27	13.08
50% depletion	3	2	2.5	142	168	155	158	175	166	44.11	15.16
75% depletion	2	2	2	129	126	127	138	153	143	48.17	16.85
Mean	3.3	2.3	—	139	163	151	176	178	177		

25 per cent depletion of available moisture (4 irrigations) and decreased to 127 mm due to irrigation at 75 per cent depletion (2 irrigations). Water requirement varied from 218 to 145 mm with treatment irrigated at 25 per cent and 75 per cent depletion, respectively. Due to high water table conditions, the consumptive use and water requirements determined appeared to be low. By polythene lining technique, it has been estimated that the contribution is about 1 mm per day. Including this contribution for 75 per cent of the crop duration (64 days), the average consumptive use and water requirements were found to be 216 and 241 mm, respectively. The contribution of ground water, however, needs further study. The water use efficiency varied from 39 to 48 kg grains per ha per cm water (Table III).

The author is thankful to the Dean, Research, Orissa University of Agriculture and Technology, Bhubaneswar and ICAR for providing facilities.

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